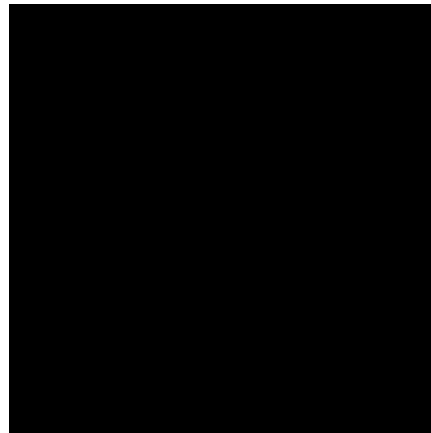




Math CAMPPP 2012

Questioning, listening and responding to
promote students' mathematical thinking

Dr. Chris Suurtamm
University of Ottawa



Reflection: Our assessment
place in the world

(An aside)



Why formative assessment?

- Research indicates that the use of formative assessment practices enhances student achievement and creates a classroom culture of success (Black & Wiliam, 1998; Brookhart, 2001; Gipps, 1994).
- With formative assessment both teachers and students have a voice in the assessment process and students develop responsibility for their learning (Arter, 2003; McMillan, 2003).

Why formative assessment?

- Formative assessment helps all students but **particularly low achievers**. Thus it helps to close the gap while raising achievement overall (Black & Wiliam, 1998).

MathGA[↑]NS →

A decorative horizontal bar at the bottom of the slide, composed of two overlapping blue shapes that create a gradient effect, rising from left to right.

Forms of formative assessment

- Conferencing
- Observation and feedback on observations
- Portfolios
- Reflective journals
- Questioning, listening and responding

Your turn

- Share in twos or threes at your table
- What are some examples of formative assessment in your context?

Focus on Questioning

- Teachers provoke students' reasoning about mathematics through the tasks they provide and the questions they ask (NCTM, 1991).
- Asking questions that reveal students' knowledge about mathematics allows teachers to design instruction that responds to and builds on this knowledge (NCTM, 2000).
- Questions are one of the only tools teachers have for finding out what students are thinking (Michaels, 2005).

Why Focus on Questioning?

Teachers' questions are crucial in helping students make connections and learn important mathematics and science concepts. Teachers need to know how students typically think about particular concepts, how to determine what a particular student or group of students' thinks about those ideas, and how to help students deepen their understanding.

Weiss & Pasley, 2004

Types of questioning > listening

Evaluative

- Listening to see if they have it right
 - So, 2 plus 3 is what?
 - And, what step comes next?

Interpretive

- Listening to understand their thinking
 - How do you know it's linear?
 - Why do you think the answer is $\frac{1}{2}$?

(Davis, 1996)

Examining questions

- Consider this problem:

Tug of war 1: 4 frogs on one side had a tie with 5 fairy godmothers on the other side.

Tug of war 2: 1 dragon had a tie with 2 fairy godmothers and 1 frog.

Tug of war 3: 1 dragon and 3 fairy godmothers on one side and 4 frogs on the other side.

Who would win the 3rd tug of war?

Teachers' questions

- Examine the questions in the transcript and consider:
 - Which lead to evaluative listening and which lead to interpretive listening?
 - Which help to make students' mathematical thinking more visible?
 - Which help to move the students' mathematical thinking forward?

A framework for examining questions

- Checking for understanding
- Promoting group interaction
- Teacher reviewing or summarizing work
- Asking students to explain their thinking
- Looking for alternate ways
- Prompting to go farther
- (Facilitating teacher observation)

Another framework for analyzing teacher questions

- | | |
|--|--|
| 1. Gathering information, leading students through a procedure | |
| 2. Inserting terminology | |
| 3. Exploring math meanings or relationships | |
| 4. Probing, getting students to explain their thinking | |
| 5. Generating discussion | |
| 6. Linking and applying | |
| 7. Extending thinking | |
| 8. Orienting and focusing | |
| 9. Establishing context | |



(Boaler & Brodie, 2004)

Continuing the dialogue: What question do I ask next?

- This is not so easy as it
 - Depends on how the student(s) has just responded
 - Depends on how well you (the teacher) listens
 - Depends on the student
 - Cannot be easily prescribed



Students' responses

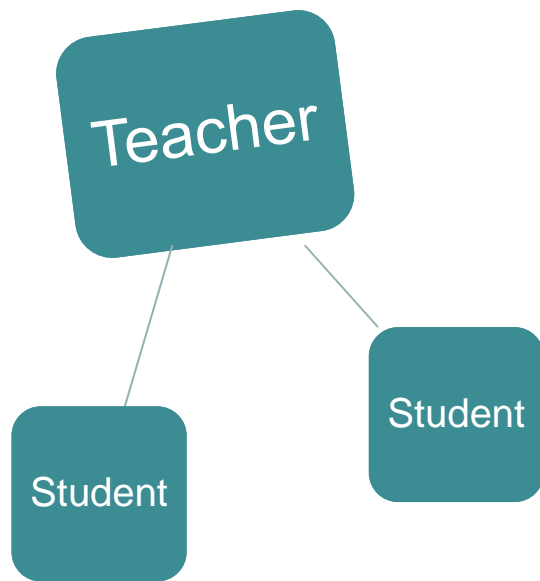
- Provide insight into their thinking
- Illuminate ways that students understand concepts (different understandings and different conceptions)
- Provide examples of ways of thinking to other students

But it is not just about teachers asking questions and students responding

MathGA[↑]NS_→

A decorative horizontal bar at the bottom of the slide, composed of two overlapping curved shapes. The bottom shape is a solid dark blue, and the top shape is a lighter blue, creating a gradient effect that rises from left to right.

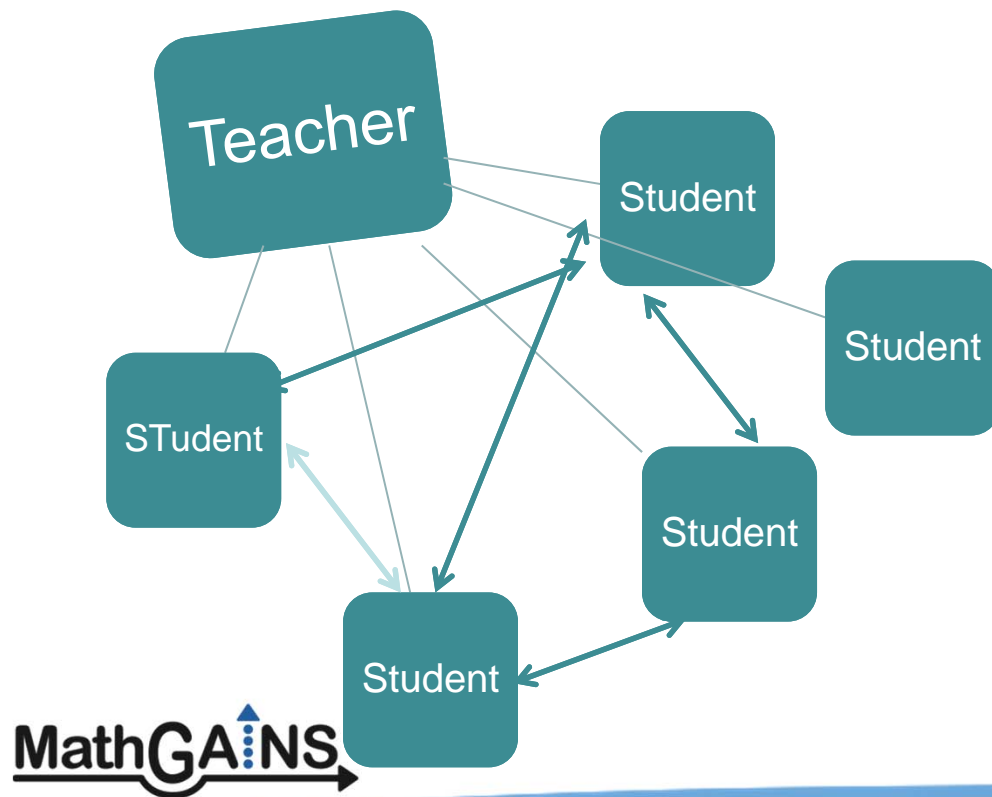
Moving from teacher to student interaction to student to student interaction



What does the network of conversation look like?

MathGA:INS

Student to student questioning



What does the network of conversation look like?

Math talk learning community

Examining student interactions

- In what ways might you describe these students' conversations?
- How do you think their discussion has been facilitated?

Providing question stems to students to promote student interaction

- Why did you use . . . ?
- What made you think to start there?
- How did the diagram (graph, model, etc.) help you solve the problem?

Descriptive feedback

- Describe specific qualities of the work in relation to the criteria
- Make observations about students' learning processes and strategies that will help them figure out how to improve
- Foster student self-efficacy by drawing connections between students' work and their mindful, intentional efforts
- Avoid personal comments

(Brookhart, 2008)



Things to consider

- **Focus** – task, process, self-regulation
- **Comparison** – criterion-referenced, self-referenced
- **Function** – descriptive, naming weaknesses or strengths in terms of criteria, suggests improvements
- **Tone** – Positive, open, seeking information

Examples

This, rather than . . .	that
Your explanation might not convince a reader that your solution is correct. What else could you do to explain your thinking?	More detail!
This solution is organized in such a way that it is very easy to follow your thinking.	Great job!
It is clear from the way you connected the diagram to the equation that you understand the algebra that you are using to solve the problem.	This is the best solution in the class!

Now you try it

- Turn to your neighbour and provide some descriptive feedback about something they did, or an experience that you had so far at Math Campppp.

Thank you

